CHAPTER TWELVE: WATER MANAGEMENT STRATEGY

12.1 INTRODUCTION

The Pinal Active Management Area (PAMA) Fourth Management Plan (4MP) historical data analysis and projections illustrate the degree to which the PAMA is affected by groundwater use. Historically, groundwater pumping has maintained a fairly constant level as Central Arizona Project (CAP) water and in-lieu CAP uses have increased, mostly supplied by the Arizona Water Banking Authority (AWBA). In the absence of in-lieu CAP and/or reductions in Non-Indian Agricultural (NIA) CAP pool water, groundwater pumping in the PAMA is likely to increase to some extent, as is Tribal groundwater demand. The goal of the PAMA recognizes the need for continued groundwater use for agricultural purposes. However, ADWR must ensure that the second portion of the PAMA goal, to preserve future water supplies for non-irrigation uses, is also achieved.

12.2 WATER MANGEMENT CHALLENGES

ADWR did not attempt to quantify the goal of the PAMA until the development of the Third Management Plan (3MP). In the 3MP, ADWR refers to the PAMA goal as "planned depletion." In the 4MP ADWR has moved away from this idea because it does not represent the best water management approach for the water users in the PAMA, nor the continued economic viability of the PAMA.

12.2.1 Groundwater Use in the PAMA and the PAMA Goal

During the 1940s, the advent of the turbine pump and the increased availability of electricity allowed a significant increase in groundwater withdrawals. Prior to the adoption of the 1980 Groundwater Code (Code) use of water was based on the "doctrine of reasonable use." Groundwater pumping increased to the point that it vastly exceeded average annual net natural and incidental recharge resulting in significant groundwater declines.

In 1980 the state legislature recognized that continued pumping would severely reduce or eliminate the overall economic viability of the state including but not limited to agriculture. The Code set the PAMA's goal to "…allow development of non-irrigation uses … and to preserve existing agricultural economies for as long as feasible, consistent with the necessity to preserve future water supplies for non-irrigation uses."

What does the PAMA goal mean?

The goal of the PAMA is to allow agriculture to continue to operate as long as it can based on other restrictions, limitations, and conditions that are outside of ADWR's authority, while ensuring that new non-agricultural development does not constitute a new perpetual drain on the aquifer. Instead, groundwater is managed to ensure that all users have a groundwater supply into the future, and ADWR's regulations do not impinge upon the ability of agriculture to continue to operate in the PAMA.

It is helpful in understanding the PAMA goal to look at the parts of the PAMA goal separately. Each component of the goal is discussed separately below.

Preserve the agricultural economies for as long as feasible

Preserve means "to keep safe from injury", or to "maintain unchanged." Economy means "the careful management of resources," or "the management of the resources of a country, community, or business." For the fourth management period, ADWR is interpreting the meaning of preserving the existing agricultural economies for as long as feasible as a signal to avoid adopting regulations that restrict the use of water by agriculture in the PAMA to such an extent that it results in a higher rate of reduction of farmland beyond the normal rate of attrition. In plain language, ADWR's aim during the fourth management period is to avoid adopting regulations that would negatively affect the lifespan of a farming operation sooner than might otherwise have occurred in the PAMA.

There are many restrictions, regulations, and conditions that affect the agricultural economy that are outside of ADWR's ability to control or regulate: the path and extent of development; the cost of chemicals, seed, labor, equipment and power; federal, county, district and city taxes; the local and global demand for agricultural products; regulations imposed by other government agencies; and weather and climate variability. However, the Code does give ADWR the authority to regulate the use of groundwater in AMAs. ADWR's mission as a state agency is to ensure long-term, reliable water supplies to support the continued prosperity of the State, which includes both agricultural (irrigation) and non-irrigation uses of water. To achieve ADWR's mission, ADWR uses the authority granted to it by the Code provisions: no new agricultural land beyond that irrigated between 1975-1979 may be brought into production; under the base conservation program, groundwater users are assigned maximum annual water allotments which restrict the use of groundwater for farming and other non-irrigation uses; flexibility accounts allow for the annual variation in commodity prices, subsidies, and weather conditions.

Since 1980 the Code has gone through several changes to allow greater flexibility for farmers in terms of the amount of water that can be used and remain in compliance with water conservation requirements:

- In 1991, effluent was excluded when determining compliance with maximum allotments
- In 1994, Irrigation Grandfathered Groundwater Rights (IGFRs) of 10 acres or less were exempted from measuring, reporting, and change of ownership notification requirements
- In 1998, conveyance of flexibility account credits accrued outside of districts to new owners was authorized
- In 2002, flexibility account credits accrued outside of districts became able to be conveyed to a farm inside a district if the farm is held by the same owner; the Agricultural Best Management Practices (BMP) program was adopted; statutory language was added to cap the maximum efficiency of irrigation water duties at 80 percent rather than 85 percent

Other changes that have occurred since 1980 that were not directly related to Code provisions include:

- In 1987, CAP water became available in the PAMA
- In 1993, CAP pool pricing for agriculture was initiated and continued through 2003. ADWR worked with the 1992 Governor's CAP Advisory Committee (Central Arizona Project, 2016) to develop incentive pricing for CAP water to make it more attractive for use by agriculture; doing so increased use of CAP in the agricultural sector and reduced groundwater pumping, allowing water levels to recover. The water level recovery helped the agricultural economy by preserving the groundwater supply and reducing pumping costs due to higher water table levels.

These changes and others have helped provide additional flexibility to the agricultural sector to allow the existing agricultural economies to continue to operate without excessively being impeded by ADWR's groundwater regulations. In addition, ADWR has taken or supported several non-regulatory actions that help preserve the agricultural economy for as long as feasible:

- In 1996, the AWBA was created, and has stored significant volumes of CAP water at groundwater savings facilities. This storage reduces groundwater pumping and preserves groundwater supplies, which lessens and in some cases reverses water table declines and risks of subsidence.
- ADWR has supported with its water management assistance funds the Irrigation Management Service (IMS) program, which provides conservation assistance to farmers to achieve higher efficiencies

Allow development of non-irrigation uses and preserve future water supplies for non-irrigation uses

The second part of the PAMA goal is to allow development of non-irrigation uses and to preserve future water supplies for non-irrigation uses. In addition to the regulations included in the Code for agriculture,

the Code included provisions related to the use of water by non-irrigation uses. This included programs for increased efficiency by municipal and industrial uses; a limit on the allotments for industrial uses; and the requirement that new subdivisions in AMAs prove an Assured Water Supply (AWS). These provisions address the preservation of water supplies for non-irrigation uses and defined the conditions under which development of non-irrigation uses may occur.

Renewable Supply Uncertainty

The goal of the PAMA recognizes the need for continued water supply for agricultural purposes. Because groundwater has been the least expensive source of water supply, groundwater pumping in the PAMA is likely to continue to some extent as long as the agricultural economy predominates. It is unclear the extent to which agricultural farmed acreage will decline as the CAP agricultural pool is reduced in 2017 and in 2030, or if agricultural groundwater pumping will increase in an amount equivalent to the reduction in availability of CAP agricultural pool water.

High volumes of continued groundwater pumping without replenishment will result in water level declines and potentially increased subsidence in the PAMA. Although grandfathered groundwater rights are perpetual, water level declines, subsidence, and earth fissuring could negatively impact the agricultural economy in the PAMA over time.

Streambed infiltration, canal seepage and groundwater inflow were noteworthy offsets to overdraft during the historical period, averaging about 182,000 ac-ft per year. Streambed infiltration varies over the historical period, representing the fluctuating supply afforded by natural conditions that cannot be projected or counted on as occurring consistently.

The PAMA has, via Groundwater Savings Facilities (GSFs), played a critical role in enabling the State to maximize its use of Colorado River water, as hundreds of thousands of ac-ft of CAP water have been indirectly stored in the Maricopa-Stanfield and Eloy sub-basins. A modest amount of the water stored will be used for PAMA municipal provider purposes, but the majority of that water will eventually serve other users. In addition, other states including California and Nevada have stored water through the AWBA. However, this use of CAP via GSFs has assisted the PAMA in meeting the first part of the management goal by preserving the local agricultural economies. In the future, much less water is likely to be available for storage at GSFs, as municipal, industrial, and tribal users grow into their allocations. The volume of water projected to be stored between 2016 and 2040 is about 1.7 million ac-ft, but projected GSF storage in the year 2040 is only projected to be about 36,000 ac-ft; this amount is, much less than the highest year of GSF storage in the PAMA, which was in 1998 when 229,000 ac-ft were delivered to be stored. Thus, the advantage of storing CAP water at GSFs to help preserve the local agricultural economy will be greatly diminished in the future, given the assumptions made in Chapter 11 of this plan.

Addressing drought management, when CAP supplies are not available or may have reduced availability, is another important consideration for future water management planning efforts. Finally, although the management goal of the PAMA is to preserve the agricultural economy for as long as feasible while preserving groundwater supplies for future non-irrigation uses, a difference in the location where water is stored relative to the location where the stored water is recovered can influence local water level declines, subsidence, earth fissures and reduced physical availability of groundwater for potential future non-irrigation uses.

Agricultural Sector

As part of the adoption of the Code, IGFRs were granted which allow farmers to withdraw groundwater for agricultural use. No new irrigated land may be brought into production beyond that which was irrigated

historically. However, an existing IGFR may be conveyed to a new owner, potentially retired to a Type 1 Non-Irrigation Grandfathered Right (Type 1 GFR), or extinguished for credits that may be used to prove the AWS requirement of consistency with the PAMA management goal. Although about 10 percent of the irrigation acres in the PAMA have either been urbanized or extinguished since 1985, and the proportion of agricultural demand met with groundwater has decreased, overall agricultural demand has increased since 1985.

It is unclear how the agricultural economy in the PAMA will respond when the NIA CAP pool is reduced and excess CAP water, used primarily by the AWBA to store at GSFs in the PAMA, becomes less available. The value of a crop would need to exceed the cost to pump groundwater, including costs to refurbish existing wells or construct new wells to meet any increase in groundwater demand that could not be met with existing district or IGFR wells. An IGFR represents a perpetual authority to withdraw groundwater without a replenishment requirement.

Incentive pricing of CAP water, the creation of the AWBA, and the volume of water the AWBA has stored in the PAMA through 2015 have resulted in limiting groundwater level declines in recent years. Decreased CAP availability, through agricultural pool reduction and through decreased availability of excess CAP, will likely result in increased groundwater pumping by the agricultural sector. This may have negative local impacts such as water level declines, additional and increasingly severe land subsidence, and water quality issues, in addition to reducing the volume of groundwater available for the future. The balance between water cost and the market value of agricultural products is the primary influence on agricultural water demand in the PAMA, but is outside the control of ADWR.

Adoption of the Agricultural Best Management Practices (BMP) program has resulted in a shift in water use patterns in the PAMA by BMP farms compared to non-BMP farms. In the PAMA there are currently about 297 enrollees in the BMP program. BMP farms use about 57 percent more water per irrigation acre than non-BMP farms, but this may be due to multiple causes. BMP farms could be double-cropping, changing crop types, or bringing more of their irrigation acres into production that previously may have been fallow. There is no limit on the number of farms that may enter the BMP program. If the trend of BMP farms using more water per acre continues, and more farms enter the program, agricultural water demand in the PAMA could continue to increase, regardless of the source of supply.

Industrial Sector

The future of industrial users in relation to the PAMA goal is largely shaped by the potential for growth in groundwater use and existing constraints on replacing groundwater use with renewable supplies. It is likely that future non-agricultural development in the PAMA will impact the availability of groundwater if unused Type 1 and Type 2 GFRs are used to meet water needs. New golf courses using these rights could have the greatest impact on industrial water use. However, golf courses also present one of the best areas in which reclaimed water or other renewable supplies could be used to help preserve groundwater supplies for all water using sectors in the PAMA.

In recent years, turf-related facilities have received roughly half of their water supply from municipal water providers serving CAP and reclaimed water in addition to groundwater. Increasing the direct use of reclaimed water would help the PAMA to maintain groundwater supplies for future non-irrigation uses. ADWR does not have authority to require industrial facilities to discontinue or reduce groundwater pumping and switch to renewable supplies but ADWR will continue to incentivize the use of reclaimed water during the fourth management period as described in chapter 6 of this plan.

General Industrial Use (GIU) groundwater withdrawal permits are a permit type that the Director is required

to issue if certain requirements are met. One of these requirements is under A.R.S. § 45-515(A)(5) which states that "the management plan for the active management area can be adjusted to accommodate the intended general industrial use consistent with the achievement of the management goal for the active management area." This provision could be further explored during the fourth management period.

Municipal Sector

The municipal sector is anticipated to continue to be dependent on groundwater during the fourth management period although use of CAP water and reclaimed water is anticipated to increase to some extent. As the municipal sector continues to grow, it will comprise a greater share of the total PAMA demand in the future.

The AWS Program has partially addressed the utilization of renewable water supplies by municipal providers by limiting the amount of groundwater that can be used. However, there is still a considerable amount of groundwater pumping allowed by providers who hold a Designation of Assured Water Supply (DAWS) under the Assured and Adequate Water Supply (AWS) Rules. This would need to be evaluated in the context of its impact on preserving future water supplies for non-irrigation uses. In addition, the water use associated with existing customers of undesignated providers and municipal uses that are not subject to the AWS Rules represent a continuing demand on the aquifer. ADWR will continue to assist the water-using community in investigating mechanisms, including possible legislative or rule changes, to address this residual overdraft.

Exempt Wells

In all AMAs except for the Santa Cruz AMA, the number of people using private domestic exempt wells for their water supply exceeds the population served by small municipal providers, who have general management plan requirements to minimize waste of water. In the PAMA, exempt well population increased from about 10,500 people in the year 2000 to an estimated 29,4976 people in the year 2014. Between 1990 and 2000 less than 500 new exempt wells were permitted in the PAMA. However, from 2000 through 2015 more than 1,300 exempt well authorizations were issued. This means that the rate of increase in exempt wells was higher between 2000 and 2014, and the number of persons per exempt well (including shared well arrangements) increased, from about two people per well in the year 2000 to nearly 10 people per well by 2015. The increase in shared wells may be due to the increased cost to drill an exempt well, which is related to some degree to increasing depths to groundwater. Exempt wells are concentrated in the PAMA west of Casa Grande and east of Florence.

ADWR does not impose any conservation requirements on exempt well water use, nor does ADWR collect any data, annual or otherwise, pertaining to water withdrawals by exempt wells. The PAMA has the highest ratio of people served per exempt well of any of the five AMAs; almost 10 people on average in the PAMA share one exempt well. This means that when there is a problem with an exempt well, several families could be affected if they all share the well.

Groundwater Allowance and the Assured Water Supply Program

In February of 1995, ADWR adopted the AWS Rules. These rules are a primary tool in achieving the PAMA's management goals and ensuring sufficient water supplies for new non-irrigation development. The AWS Rules require that developers of new subdivisions demonstrate the availability of renewable, non-mined groundwater supplies that are sufficient to meet the demand of the development for 100 years, either by obtaining a Certificate of Assured Water Supply (CAWS) or by receiving service from a water provider with a DAWS. While new subdivisions and DAWS providers must limit their overall use of mined groundwater, a specified amount of mined groundwater is allocated to them. Any groundwater use above the mined groundwater allocation must be replenished. If a CAWS applicant or water provider does not

have access to a renewable water supply, the development or service area may enroll in the Central Arizona Groundwater Replenishment District (CAGRD) to satisfy its replenishment obligation. If a municipal provider is a member service area, or a subdivision is a member land of the CAGRD, any groundwater withdrawn in excess of the mined groundwater allocation must be replenished within the AMA by the CAGRD within three years.

The initial AWS Rules in the PAMA gave generous allowances of groundwater that were not required to be replenished. The AWS Rules were so generous in the PAMA that many subdivisions issued AWS during that period of time will never need to replenish their groundwater use, resulting in additional groundwater mining in the PAMA, which affects all economies, including the agricultural economy.

In 2007, recognizing that the AWS Rules for the PAMA did not provide for the achievement of ADWR's mission or the PAMA goal, the AWS Rules were tightened for new development in the PAMA, restricting the volume of groundwater allowance granted for CAWS and DAWS, which then requires that more of the groundwater use by CAWS and DAWS be replenished.

The 1995 AWS Rules also contained a provision whereby IGFRs and other groundwater rights could be extinguished, meaning they could no longer be used as a basis to withdraw groundwater to grow crops or for any other purpose. Credits generated from an extinguishment could then be pledged to new development in AMAs. Again, in the PAMA the original extinguishment provisions did not restrict the use of groundwater by new subdivisions, but instead were perpetual allowances of groundwater, granting a volume of groundwater that could be used each year in perpetuity.

The 2007 AWS Rule modification of provisions in the PAMA also changed how extinguishment credits could be issued in the PAMA. The modified rule limits the volume of extinguishment credits that can be generated; they are no longer a perpetual, annually-renewing volume. Perpetual credits do not result in the maintenance of a long-term, secure water supply for the population of the PAMA, regardless of whether people are engaged in agricultural or other endeavors. More groundwater is still being used in the PAMA than is being replenished naturally, artificially, or incidentally on an annual basis.

As of 2015, municipal water use accounted for less than four percent of all water used in the PAMA. About 32 percent of the AMA's municipal demand in 2015 was within service areas of providers who hold a DAWS. Of the five DAWS water providers in the PAMA, four are members of the CAGRD. Once a provider has joined the CAGRD, the CAGRD is committed in perpetuity to replenish the demand that existed within that service area during the membership period in addition to the demand of new developments. The AWS Program should significantly influence the use of renewable water supplies in the AMA.

Most private water companies in the AMAs have chosen not to be designated. As of 2015, two private water companies in the PAMA hold a DAWS: Santa Cruz Water Company and Johnson Utilities - Pinal. Several companies which formerly held a DAWS have decided not to reapply (see Chapter 5). New developments in undesignated providers' service areas must have a CAWS, but undesignated water providers are expected to continue to pump groundwater to serve their existing customers. This ongoing use of mined groundwater jeopardizes the ability of the PAMA to preserve groundwater supplies for future non-irrigation uses.

Table 12-1 shows the status of provider AWS Designations. Arizona Water Company – Pinal Valley system, the largest municipal provider in the PAMA, does not hold a designation under the AWS Rules.

About 34 percent of the PAMA population in the year 2015 was within the service area of a provider with a DAWS.

TABLE 12-1
ASSURED WATER SUPPLY STATUS
PINAL ACTIVE MANAGEMENT AREA

Provider	2015 Water Service Area Population	2015 Water Demand (acre-feet)	Designation Volume (acre-feet per year)
City of Casa Grande	608	155	4,113
City of Eloy	8,535	1,678	49,159
Johnson Utilities - Pinal	4,106	1,202	1,595
Santa Cruz Water Co.	44,960	5,837	22,914
Town of Florence	11,659	1,730	15,069
TOTAL	**69,867**	**10,602**	**92,851**

As of December 2015, there were nine large (serving more than 250 acre-feet) and approximately 30 small undesignated providers in the PAMA (one small provider, the City of Casa Grande, is designated, however it does not serve the majority of the incorporated area of Casa Grande). Some undesignated providers may have the ability to participate in augmentation efforts. The 2015 groundwater demand by large providers in the PAMA who are not designated was 13,357 ac-ft. Large providers who do not have a DAWS served 91,347 people in 2015. Efforts to encourage use of renewable water supplies in this sector merit further attention as a component of the Underground Storage, Savings and Replenishment (Recharge) Program in the PAMA.

12.2.2 Underground Storage and Recovery

The major storer in the PAMA has been the AWBA. The AWBA does not project significant additional storage activity in the PAMA into the future, but significant AWBA storage has occurred during the historical period through 2015. At some point, the AWBA will begin to recover the stored water. In April of 2014, ADWR, the AWBA and the CAP published "Recovery of Water Stored by the Arizona Water Banking Authority: A Joint Plan by AWBA, ADWR and CAP." This document generally describes how the AWBA's long-term storage credits could be recovered; however, further details and consideration of the PAMA conditions such as land subsidence and water table levels are needed to fully implement the joint recovery plan. Continued monitoring, data collection, and analysis related to groundwater movement, amounts of groundwater in storage, water levels, decline rates, and land subsidence in the PAMA is needed. Lessening the distance between storage and recovery can help mitigate these issues.

12.2.3 Groundwater Savings Facilities

Most water stored in the PAMA is CAP water stored at GSF facilities. As the volume of excess CAP available lessens with increased utilization of CAP subcontract volumes, less CAP water will be delivered to the PAMA GSF facilities. It is possible but uncertain whether the irrigation districts and the agricultural community will make up the difference in supply by pumping an equivalent amount of groundwater. Much depends on the agricultural economy and the cost of withdrawing groundwater.

12.2.4 Conservation Insufficient to Preserve Groundwater Supplies

Efficient use of all water supplies is prudent, especially in the arid Southwest. ADWR conservation programs encourage efficient use of all water supplies; however, conservation alone is not sufficient to result in the achievement of the PAMA goal because replenishment is not required for most water demand sectors, certain groundwater rights are perpetual, and certain segments of municipal demand can continue

to grow on groundwater.

12.2.5 Reclaimed Water Use

Use of reclaimed water, either directly or through underground storage and recovery, represents a future supply for the PAMA and can add physical availability if the water is stored and recovered within the hydrologic area of impact of where the water was stored. However, only a small amount of reclaimed water has historically been used in the PAMA, representing less than one percent of total supplies used.

ADWR has historically provided an incentive for the use of reclaimed water instead of groundwater and other sources of supply. The Turf Program in the industrial sector allows turf facilities to receive a discount on every acre-foot of reclaimed water used. This incentive was originally included in the management plans to encourage the replacement of groundwater with reclaimed water in the turf sector; the incentive can help outweigh the additional cost of delivering and treating reclaimed water. However, this incentive may result in irrigation managers becoming less concerned about the volume of water being applied to the turf, and hence result in the application of more water than the minimum amount the turf actually needs, which might otherwise be stored underground and used to meet demand at a future date. However, the increased costs of reclaimed water versus groundwater may mitigate the concern for economic reasons.

Use of septic systems reduces the amount of wastewater that may be reclaimed and reused. Further, septic system leachate cannot be directed to areas where water levels are declining as can wastewater collected through a centralized sewer system, which can be treated and stored underground under a water management strategy that addresses sub-regional areas within the PAMA.

In calculating the amount of long-term storage credits (LTSCs) earned by a storer, there is currently no cut to the aquifer for reclaimed water stored at a constructed underground storage facility. This means that 100 percent of the water sent to store, minus evaporative losses and other debits, is recoverable.

12.2.6 Susceptibility of CAP Supplies to Shortage

The use of CAP water and in-lieu water, primarily in the agricultural sector, in the PAMA has accounted for as much as 50 percent (in 2002) of the supply and was 33 percent of the supply in 2015. However, a reduction in CAP supplies could increase the use of groundwater and result in additional groundwater level declines and corresponding reduction in physical availability of groundwater for future growth.

12.2.7 Limitation on Renewable Supplies

The 4MP projects that CAP water will be fully utilized within the three AMA CAP water service area by the year 2025. Further, availability of CAP water may experience a reduction due to shortage prior to that. Shortage of CAP water would reduce the amount of excess CAP water, on which the AWBA relies, as well as the CAP agricultural pool. This may result in an earlier increase in groundwater pumping by agriculture in the PAMA than anticipated.

The AWS Rules require future growth to use renewable water supplies. After the year 2025, no additional groundwater allowance for AWS determinations is granted in the AWS Rules. After the year 2054, no additional extinguishment credits will be granted for the extinguishment of a GFR in the PAMA. Use of reclaimed water will become more important, and eventually additional renewable supplies will be needed.

12.3 POSSIBLE SOLUTIONS

During the fourth management period, ADWR will continue to work with the regulated community to develop long-term water management solutions to address the challenges described in section 12.2, and to

identify issues and develop and implement solutions to water management challenges.

12.3.1 Agricultural Solutions

Although IGFR holders will continue to hold the right to pump and use groundwater in perpetuity, reductions in agricultural groundwater use are beneficial in achieving and maintaining the goal of the PAMA. The increased utilization of renewable water supplies to replace groundwater use, combined with demand reduction efforts to enhance on-farm irrigation water management practices, are key factors in meeting this water resource management goal.

ADWR will continue to work cooperatively with the agricultural community to ensure that existing conservation requirements are effective and appropriate. In addition, ADWR will also work closely with the agricultural community throughout the fourth management period to ensure that the BMP Program is an effective and efficient agricultural water conservation program that helps move the PAMA closer to the achievement of its goal. ADWR, in conjunction with the BMP Advisory Committee, will monitor and analyze both existing and newly implemented BMPs.

ADWR will continue to monitor crop and water use patterns during the fourth management period to assess agriculture's impact on achieving the goal for the PAMA and to evaluate the effects of ADWR programs on farming operations. The impacts of the agricultural market on water use trends will also be evaluated for future planning needs. ADWR will also encourage and evaluate incentives for the increased use of reclaimed water by the agricultural sector.

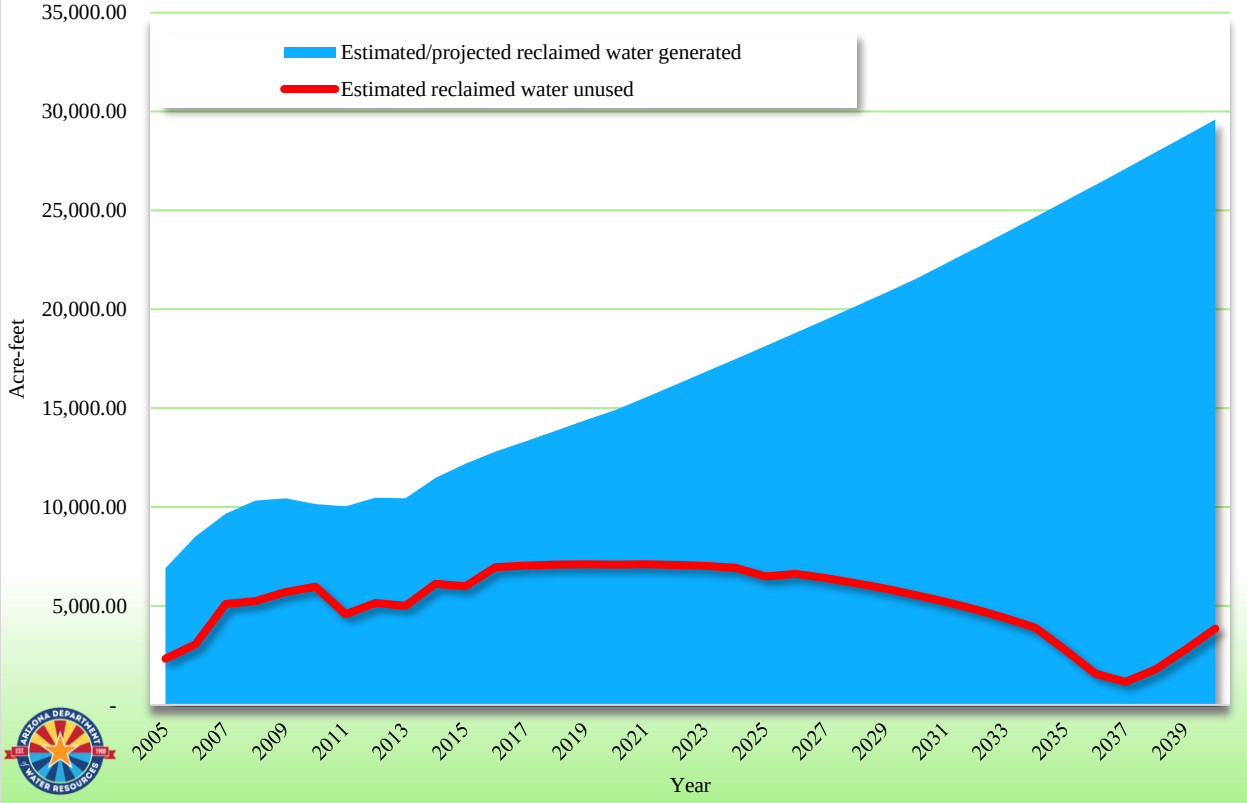
To completely eliminate overdraft in the agricultural sector, agricultural users would need to rely almost exclusively on renewable supplies or be required to replenish groundwater pumping.

12.3.2 Industrial Solutions

The future of industrial use in relation to the PAMA goal is largely shaped by the potential for growth in groundwater use and existing constraints on replacing groundwater use with renewable supplies.

In order to help preserve water supplies for the future, there must be continuing and enhanced water use efficiency, meaningful incentives for the use of renewable water supplies, and viable administrative and physical renewable resource use mechanisms in place. The majority of direct use of reclaimed water during the fourth management period is projected to continue to be used by three IGFRs and within the industrial sector for turf irrigation. However, there is potential for additional direct use of reclaimed water for turf irrigation and for increased underground storage of reclaimed water in the PAMA *(Se Figure 12-1)*. In order for this to occur, there would need to be either regional infrastructure cost sharing for direct use to make it economically viable to use a renewable supply, or low-cost replenishment mechanisms whereby pumped groundwater would be replenished by a renewable supply elsewhere in the PAMA under certain conditions.

FIGURE 12-1
PINAL AMA ESTIMATED AND PROJECTED RECLAIMED WATER GENERATED AND PORTION OF RECLAIMED WATER UNUSED, 2005 - 2040



Apart from the groundwater right retirement provision in the Code and the groundwater right extinguishment provisions in the AWS Rules, there is currently no regulatory authority that could reduce grandfathered groundwater rights. ADWR has determined that a purchase and retirement program, even with $2.00 per acre-foot withdrawal fee funding, would not produce a meaningful amount of groundwater pumpage savings. The extent to which the extinguishment provisions in the AWS Rules will limit industrial use is impossible to predict. It may be necessary to explore groundwater replenishment approaches to offset a portion of industrial pumpage. Approaches such as expanding the authority of the CAGRD to recharge excess CAP water outside of the AWS Program or establishing a separate replenishment authority for industrial users are possible mechanisms. Statutory change would be necessary to implement either mechanism.

Management of aquifers during the fourth management period may involve the development of water management strategies to address localized water conditions, promoting withdrawals in areas experiencing groundwater recharge and discouraging withdrawals from areas experiencing severe declines. For Industrial uses this could mean encouraging the extinguishment of GFRs in specified areas.

Industrial water uses may change as new technologies are developed. Research may need to be conducted during the fourth management period to investigate water conserving opportunities associated with use of these technologies by certain industrial users. This research could be used to develop conservation requirements for the 4MP.

12.3.3 Municipal Solutions

The municipal sector is expected to continue its reliance on groundwater during the fourth management period. The AWS Rule groundwater allowance and extinguishment credit provisions continue until the year 2054. There is limited incentive for municipal providers in the PAMA to begin using more renewable supplies and less groundwater. By 2040, the 4MP projects that municipal groundwater demand will more than double, from about 30,000 ac-ft in 2014 to nearly 70,000 ac-ft by 2040. There is still a considerable amount of groundwater pumping allowed by DAWS providers under the AWS Rules that must be evaluated in the context of its impact on the preservation of groundwater supplies. In addition, the water use associated with existing customers of undesignated providers and municipal uses that are not subject to the AWS Rules represent a continuing demand on the aquifer. During the fourth management period, ADWR will explore opportunities to help preserve water supplies in the PAMA for the future of all users in the AMA.

The development of sub-regional water management policies within AMAs can help protect against aquifer degradation and land subsidence. This may include the development of water management strategies to promote withdrawals from areas experiencing recharge rather than areas experiencing severe declines.

ADWR will continue to work with the Arizona Corporation Commission in the development of policies related to water conservation and supply acquisition and on conditions for appropriate recovery of costs for private utilities associated with the ADWR's regulatory programs.

Although the existing mandatory water conservation programs have been effective in reducing the overall water demands, during the fourth management period, ADWR will continue to evaluate their effectiveness. Further evaluation could include ADWR assisting in designing follow-up studies and analyses to evaluate program effectiveness. This may include focusing the Water Management Assistance Program on municipal research or evaluation projects.

Throughout the fourth management period, ADWR will work to improve water use data collection to support both planning and conservation program evaluation efforts. ADWR will also continue to provide direct conservation assistance to water providers to assist them in meeting their regulatory requirements.

12.3.4 Augmentation Solutions

During the fourth management period and beyond, ADWR, working with the local jurisdictions, may consider the following potential solutions to increase the use of renewable water supplies in the PAMA, thereby further reducing groundwater dependency:

(1) Further incentivize the achievement of full utilization, either directly or through underground storage and recovery within the area of impact of storage of CAP and reclaimed water.
(2) Mitigate, through local water management incentives and regulations, the occurrence of land subsidence, earth fissuring, decreases in well productivity, water level declines, decreases in water quality, and loss of riparian habitat, due to water withdrawals through regulations that encourage storage of water in areas experiencing declines (where appropriate hydrologically), and recovering water where the water is stored.
(3) Develop and adopt economic incentives to achieve water management objectives both at the AMA and local levels.
(4) Address residual groundwater pumping and allowable groundwater pumping in the municipal sector.
(5) Consider the cost effectiveness of reclaiming brackish, high Total Dissolved Solids (TDS) or other poor quality water not previously considered for beneficial use.

12.4 SUMMARY

Although agricultural uses of water made up 80 percent of the total PAMA water demand in 2015, and are projected to still comprise at least 64 percent of the total PAMA water demand by 2040, ensuring a safe, sufficient, long-term water supply for municipal and industrial uses remains ADWR's mission for the PAMA as well as the entire state. The greater the volume of groundwater that may be withdrawn legally in the PAMA and not replenished, by any water use sector, the less groundwater will be available to meet future water demands, particularly during times when less renewable water supplies are available.